Pesticide Monitoring and Assessment in MI

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Pesticide Monitoring Studies

Using immunoassays for screening of select pesticides

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USGS-MDEQ Cooperative Pesticide Monitoring

1. Use of immunoassay for the detection of atrazine, metolachlor, simazine, chlorpyrifos, and diazinon in streams

2. Atrazine study in the St. Joseph River Watershed-stream and streambed pore-water

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Immunoassay-
Pros and Cons

PROS	CONS
Inexpensive	Can only analyze one analyte at a time
High throughput	High detection limit
Quick screening	Non-specific

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Immunoassay Detection Limits

	Usage	Immunoassay detection limit	Lab analysis detection limit
Herbicides			
Atrazine	Several crops, majority on corn and soybeans	0.046 µg/L	0.001 µg/L
Metolachlor	Several crops, majority on corn and soybeans	0.05 µg/L	0.002 µg/L
Simazine	Several crops, primarily fruits and urban weed control	0.03 µg/L	0.005 µg/L
Insecticides			
Diazinon	Primarily urban insect control, little on field crops, being phased out	0.022 µg/L	0.002 µg/L
Chlorpyrifos	Widely used on field crops, being phased out as a urban use	0.1 µg/L	0.004 µg/L
Aldicarb	Primarily for soybean aphid control	4 µg/L	0.016 µg/L

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2005 Monitoring Study

1. Measure pesticide concentrations at selected stream sites throughout Michigan.
2. Provide data that will increase understanding as to when and where to sample most effectively for pesticides.
3. Provide data to aid in the development of a more comprehensive monitoring study.
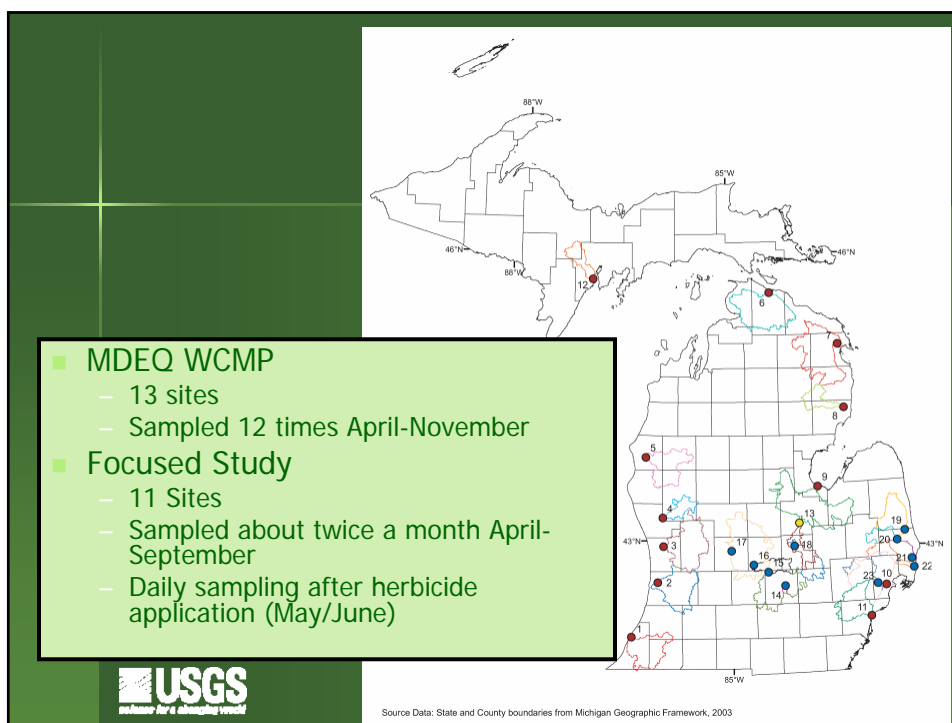4. Correlate pesticide concentrations with other water-quality constituents.

http://pubs.usgs.gov/sir/2007/5077/

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In cooperation with Michigan Department of Environmental Quality

Screening for the Pesticides Atrazine, Chlorpyrifos, Diazinon, Metolachlor, and Simazine in Selected Michigan Streams, March–November 2005
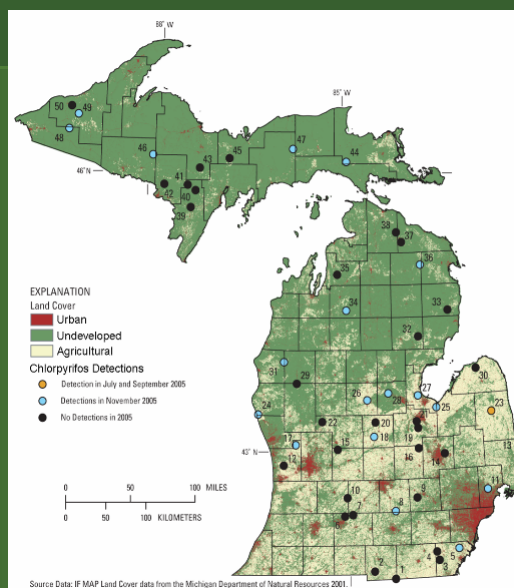
Scientific Investigations Report 2007–5077

U.S. Department of the Interior
U.S. Geological Survey

- **MDEQ WCMP**
  - 13 sites
  - Sampled 12 times April-November
- **Focused Study**
  - 11 Sites
  - Sampled about twice a month April-September
  - Daily sampling after herbicide application (May/June)

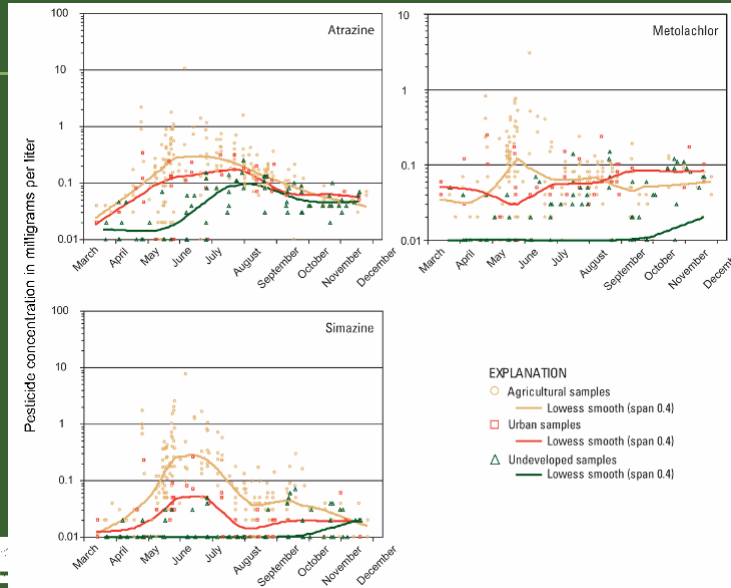Source Data: State and County boundaries from Michigan Geographic Framework, 2003
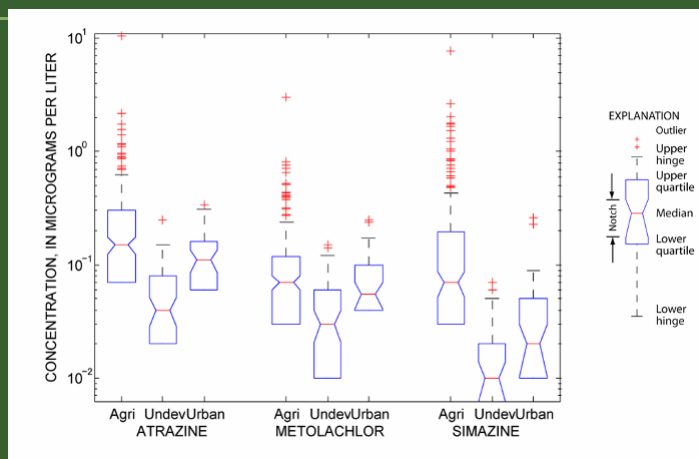
Seasonal Patterns in Insecticide Concentrations

- Diazinon was not detected in any samples
- Chlorpyrifos was not detected in samples from watershed monitoring study
- Chlorpyrifos was detected in MDEQ statewide assessment in 18 out of 50 sites in Nov. and 1 site in July and Sept., 2005


EXPLANATION
Land Cover
- Urban
- Undeveloped
- Agricultural

Chlorpyrifos Detections
- Detection in July and September 2005
- Detections in November 2005
- No Detections in 2005

0   50   100 MILES
0   50   100 KILOMETERS

Source Data: IF MAP Land Cover data from the Michigan Department of Natural Resources 2001.

Seasonal Patterns in Herbicide Concentrations

Influence of Land-Use

Daily Sampling Following Spring Rain
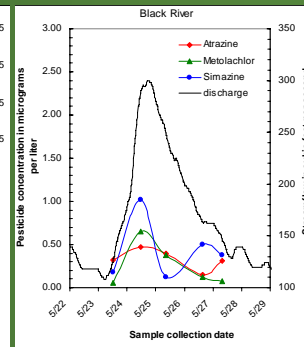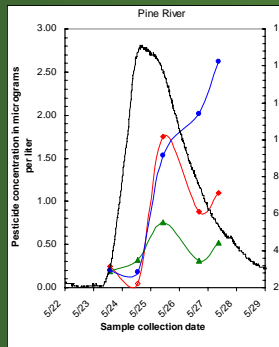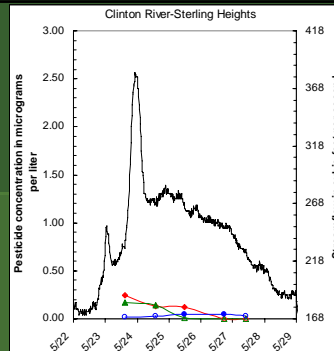
St. Joseph River Watershed Study

- Determine whether atrazine was present in stream water
- Determine spatial and temporal variations of atrazine concentrations
- Investigate pore-water/stream-water interactions.


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Prepared in Cooperation with the Michigan Department of Environmental Quality

Atrazine Concentrations in Stream Water and Streambed Sediment Pore Water in the St. Joseph and Galien River Basins, Michigan and Indiana, May 2001 – September 2003
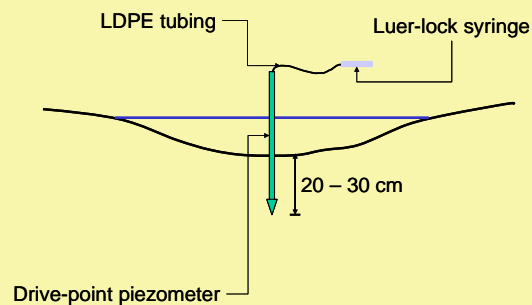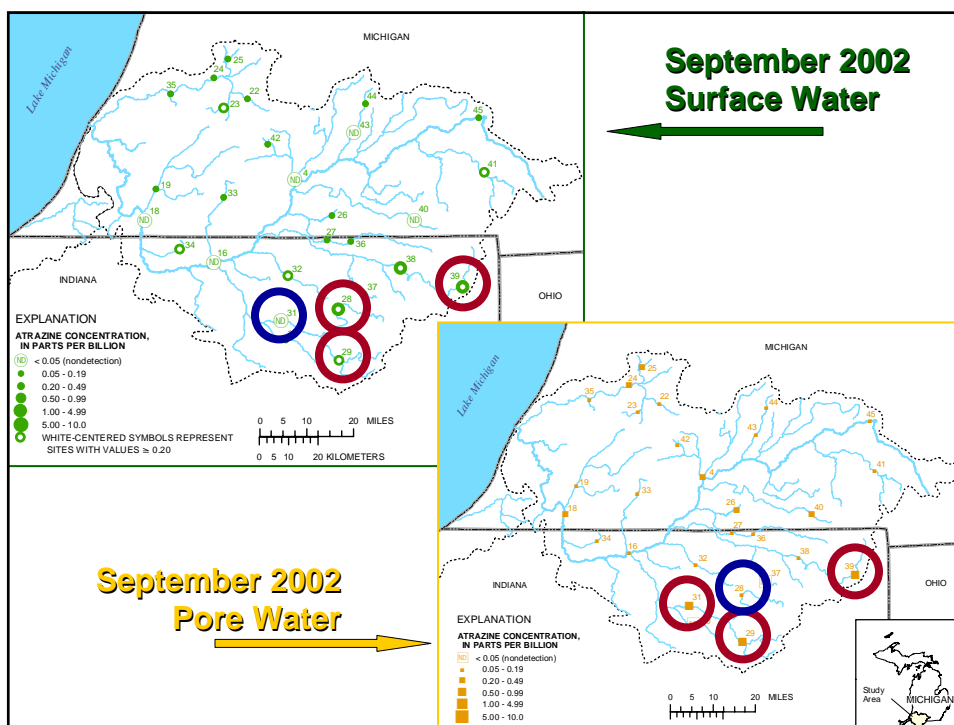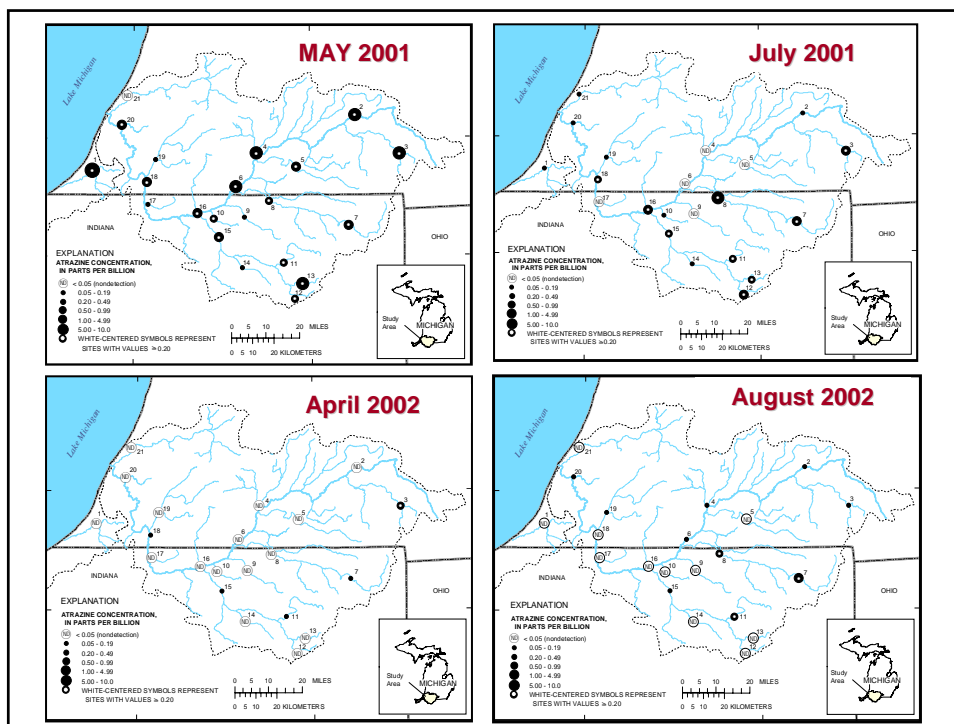
Open-File Report 2004-1326

U.S. Department of the Interior
U.S. Geological Survey

St. Joseph River Watershed-Atrazine sampling sites
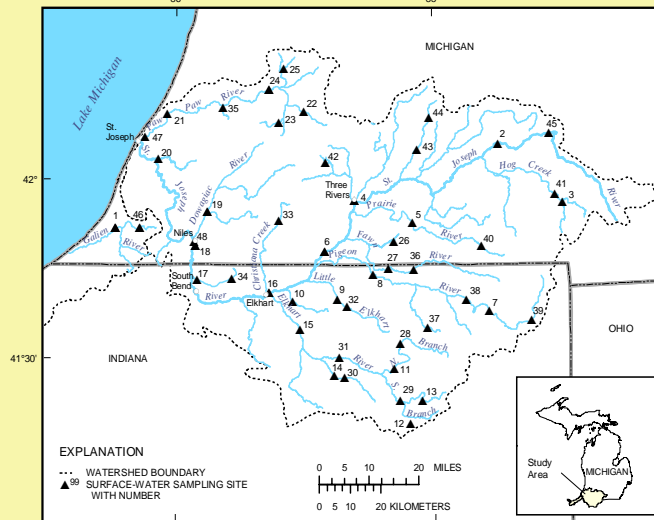
Pore Water Sampling

Summary of MI Pesticide Studies

- Immunoassay are an inexpensive method to screen a large number of samples for select pesticides
- Monitoring studies in Michigan have shown:
    1. Atrazine, metolachlor, and simazine are usually only detected in low concentrations in stream and pore-waters.
    2. Highest concentrations typically occur in late Spring
    3. Highest pesticide concentrations occurred in agricultural areas; however, there was little statistical difference in the overall concentrations between urban and agriculture land-use samples
    4. Areas with little development in MI, had very few pesticide detections

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Pesticide Standards and Assessment in Michigan

- Drinking water
- TMDLs
- Criteria development
- MI Dept. of Agriculture activities

Public Water Supply Surface Water Intakes

Source: SDWIS database

Drinking Water Assessment For Pesticides/Herbicides

- Monitoring at plant taps 1x/quarter for 33 synthetic organics
- Reduced frequency based on:
  - previous data
  - contaminant use in watershed
  - surface water vs. groundwater
- Monitoring waivers based on random and targeted monitoring in the 1990s

Pesticide Criteria Development

- Based on GLI
- Human health – cancer, non-cancer; drinking water source
- Wildlife values for BCCs – protect mammals and piscivorous birds
- Aquatic Life – acute and chronic values
- Criteria developed for many pesticides

Pesticide TMDL Schedule

- TMDLs for chlordane and DDT
- Fish consumption advisories
- 2010 - Chlordane
  - Galien River
  - White Lake
  - Glen Lake
  - Higgins Lake
  - Lake Orion

Pesticide TMDL Schedule (cont.)

- 2012 - Chlordane & DDT
  - Lake Huron
  - Lake Michigan
  - Lake Superior
  - Detroit River

- Sources are atmospheric deposition and contaminated sediments

MDA Groundwater Monitoring

- Screening; determine relative risk
- Voluntary
- Probabilistic and targeted
- Since 1989, ~ 4,300 wells sampled w/standard analysis; 22,000 screened for atrazine by immunoassay
- 112 (2.6%) wells contaminated by one or more pesticides

MDA Emerging Issues

- Pesticide metabolites
- Pharmaceutical metabolites
- State-wide groundwater monitoring network
- Monitoring to support model development